

**REMARKS**

Claims 1 through 136 are currently pending in the application.

This amendment is in response to the Office Action of May 6, 2003.

Claims 9 through 13, 35 through 39, 44 through 48, 57 through 61, 83 through 87, 92 through 96, 105 through 109 and 117 through 136 are withdrawn from consideration.

Claims 1 through 8, 14 through 34, 40 through 43, 49 through 56, 62 through 82, 88 through 91, 97 through 104 and 110 through 116 are rejected.

Reconsideration of the above-referenced application is respectfully requested.

**Rejections Under 35 U.S.C. § 102**

**Sahara et al**

Claims 1 through 5, 19 through 26, 27 through 31, 40 through 43, 49 through 53, 67 through 79, 88 through 91, 97 through 101, 115 and 116 are rejected under 35 U.S.C. § 102(b) as being anticipated by Sahara et al. (U.S. Patent 4,764,804).

Applicants submit that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Additionally, the elements must be arranged as required by the claim, but identity of the terminology is not required. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990).

Sahara describes a semiconductor device assembly having improved heat-dissipating characteristics (see Abstract). The semiconductor device assembly may comprise a mother chip 1 that is defined by a wiring board with a circuit function (col. 2, lines 63-64), or a child chip 3. The mother chip 1 includes a silicon substrate and has a multilayer wiring structure consisting of an aluminum film 7 and an insulator film 6 (col. 3, lines 10-21). A thin diamond film 11 is formed on the surface of the mother chip 1 (col. 3, lines 32-33). The thin diamond film 11 has an aperture therein (see Fig. 2). A metal barrier (bond pad) 10 having a periphery extends at least partially over the thin diamond layer 11 adjacent to the aperture (see Fig. 2). The metal barrier

10 is in communication with a conducting bump 8 and the aluminum electrode wiring 7 in order to electrically connect the mother chip to the child chip (col. 3, lines 25-28). Additionally, the thin diamond layer 11 may replace all the insulator film 6 (col. 4, lines 59-60) (see Fig. 2 generally).

A surface of the child chip 3 may have an insulator film 6 formed thereon. A thin diamond film 11 is formed over the insulator film 6 having an aperture therein. A barrier metal 10 or bond pad is positioned adjacent to and extends through the aperture. This barrier metal 10 is electrically connected to an aluminum wiring 7, which is laid on the surface of the insulating film 6, so as to electrically connect the child chip 3 and mother chip 1 (see Fig. 2).

It is respectfully submitted that Sahara does not anticipate the subject matter contained in presently amended claims 1 through 5, 19 through 26, 27 through 31, 40 through 43, 49 through 53, 67 through 79, 88 through 91, 97 through 101, 115 and 116.

Independent claim 1 recites a semiconductor device assembly comprising a substrate having a surface, "a passivation layer provided over at least a portion of said surface of said substrate, a second passivation layer provided over at least a portion of said first passivation layer, [and] a layer comprising substantially diamond provided over at least a portion of said second passivation layer..." Thus, the presently claimed invention of amended claim 1 requires a substrate having two passivation layers between a surface of the substrate and a layer comprising substantially diamond.

It is respectfully submitted that Sahara lacks any express or inherent description of a semiconductor device assembly comprising a substrate having multiple passivation layers between a surface of the substrate and a layer comprising substantially diamond. The semiconductor device assembly Sahara discloses has only a single insulating film 6 between a thin diamond film 11 and the mother chip 1, or, alternatively, the thin diamond film 11 may replace all the insulator film 6 (col. 4, lines 59-60).

For this reason, it is respectfully submitted that, under 35 U.S.C. § 102(b), claim 1 is allowable over Sahara.

Claims 2 through 5, and 19 through 26 are allowable as depending from allowable base claim 1, in addition to any patentable subject matter contained therein.

Independent claim 27 requires a semiconductor die assembly comprising a substrate having a surface, "a passivation layer, said passivation layer provided over at least a portion of said surface of said substrate, a second passivation layer, said second passivation layer provided over said passivation layer, a layer including diamond... provided substantially over said second passivation layer..." As such, claim 27 requires two passivation layers between the surface of the substrate and the layer including diamond.

Sahara does not describe each and every element of claim 27. Required by claim 27 is a semiconductor die assembly having at least two passivation layers located between a substrate surface and a layer including diamond. The semiconductor device assembly Sahara discloses has only a single insulating film 6 between a thin diamond film 11 and the mother chip 1, or, alternatively, the thin diamond film 11 may replace all the insulator film 6 (col. 4, lines 59-60).

Therefore, it is respectfully submitted that, under 35 U.S.C. § 102(b), independent claim 27 is allowable over Sahara because each and every element as set forth in the claim is not inherently or expressly described in the cited prior art.

Claims 28 through 31 are allowable, among other reasons, as depending from allowable base claim 27.

Independent claim 40 recites a heat sink disposed on a substrate comprising "a passivation layer disposed on at least a portion of a surface of a substrate, a second passivation layer disposed on at least a portion of said passivation layer, [and] a layer including diamond disposed on at least a portion of said second passivation layer..." Sahara does not inherently or expressly describe a heat sink comprising two passivation layers disposed between a substrate surface and a layer including diamond.

As such, it is respectfully submitted that, under 35 U.S.C. § 102(b), independent claim 40 is allowable over Sahara because the cited prior art fails to describe each and every element as required by the claim.

Further, claims 41 and 43 are each allowable as depending from allowable base claim 40, in addition to any patentable subject matter contained therein.

It is respectfully that independent claim 49 is allowable over Sahara because the cited prior art fails to inherently or expressly describe "a semiconductor device having an active

surface, having a passivation layer provided over at least a portion of said active surface of said semiconductor device, having a second passivation layer provided over at least a portion of said passivation layer, [and] having a layer comprising substantially diamond provided over at least a portion of said second passivation layer...” Sahara discloses a semiconductor device with only an insulating layer provided between a thin diamond layer and a surface of the semiconductor device.

Therefore, it is respectfully submitted that, under 35 U.S.C. § 102(b), independent claim 49 is allowable over Sahara because the cited prior art fails to inherently or expressly describe each and every element as required by the claim.

Claims 50 through 53, and 67 through 74 are allowable as depending from allowable independent claim 49, in addition to any allowable subject matter contained therein.

Similar to previous arguments, independent claim 75 is allowable over Sahara because the cited prior art fails to describe each and every element as is required by the claim. Independent claim 75 recites “a semiconductor die having an active surface, a passivation layer, said passivation layer provided substantially over a portion of said active surface of said semiconductor device, a second passivation layer, said second passivation layer provided substantially over a portion of said passivation layer, [and] a layer having at least one aperture therein, said layer including diamond provided substantially over a portion of said second passivation layer...”

It is respectfully submitted that, under 35 U.S.C. § 102(b), independent claim 75 is allowable over Sahara because the cited prior art fails to inherently or expressly describe a semiconductor die having two passivation layers between an active surface of a semiconductor die and a layer including diamond.

Applicant respectfully submits that claims 76 through 79 are allowable, among other reasons, as being dependent upon allowable independent claim 75.

Independent claim 88 requires “a heat sink disposed on a semiconductor device comprising [] a passivation layer disposed on at least a portion of an active surface of a semiconductor device, a second passivation layer disposed on at least a portion of said passivation layer, [and] a layer including diamond disposed on at least a portion of said second

passivation layer...” Sahara does not inherently or expressly describe a heat sink disposed on a semiconductor device having two passivation layers disposed between a layer including diamond and an active surface of a semiconductor device.

It is respectfully submitted that, under 35 U.S.C. § 102(b), independent claim 88 is allowable over Sahara because the cited prior art does not inherently or expressly describe each and every element as required by the claim.

It is respectfully submitted that claims 89 through 91 are allowable as depending from allowable base claim 88, in addition to any patentable subject matter contained therein.

Applicant respectfully submits that independent claim 97 is allowable over Sahara because the cited prior art fails to inherently or expressly describe each and every element as is set forth in the claim. Independent claim 97 claims “a semiconductor die comprising [] a substrate having a surface, at least one circuit located on said substrate, a passivation layer provided over at least a portion of said surface of said substrate, a second passivation layer provided over at least a portion of said passivation layer, [and] a layer including diamond provided over at least a portion of said second passivation layer...” Sahara fails to describe a semiconductor die comprising two passivation layers provided between a surface of a substrate and a layer including diamond.

Therefore, it is respectfully submitted that, under 35 U.S.C. § 102(b), independent claim 97 is allowable over Sahara because the cited prior art does not describe each and every element as set forth in claim 97.

Applicant respectfully submits that claims 98 through 101, and 115 through 116 are allowable, among other reasons, as being dependent from base claim 97, which is also allowable.

### **Rejections Under 35 U.S.C. § 103**

Applicants submit that to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the cited prior art reference must teach or suggest all of

the claim limitations. Furthermore, the suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicants' disclosure.

Sahara and Garg

Claims 7 through 8, 14 through 18, 33 through 34, 55 through 56, 62, 66, 81 through 82, 103 through 104, and 110 through 114 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sahara et al. (U.S. Patent 4,764,804) in view of Garg et al. (U.S. Patent 5,126,206).

Garg teaches or suggests a coated substrate product which comprises a substrate and a polycrystalline diamond layer (see Abstract). The polycrystalline diamond layer can be from 0.5  $\mu\text{m}$  (5,000 Angstroms) to 250  $\mu\text{m}$  (2,500,000 Angstroms) in thickness (col. 8, lines 39-40). The diamond layer may comprise other materials such as amorphous carbon (col. 11, line 48) or hydrogen (col. 12, lines 41-42).

It is respectfully submitted that claims 7 through 8, and 14 through 18 are allowable, among other reasons, as depending either directly or indirectly from independent claim 1.

Regarding independent claim 1, Sahara fails to teach a semiconductor device assembly comprising two passivation layers provided between a substrate surface and a layer comprising substantially diamond. The teachings of Gard fail to remedy this deficiency to establish a *prima facie* case of obviousness regarding the claimed invention under 35 U.S.C. § 103. Therefore, any combination of the cited prior art fails to teach or suggest the claim limitations of the presently claimed invention to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed invention.

Regarding claim 8, Gard fails to teach a "layer comprising substantially diamond [having] a thickness of between about 50 and 2000 angstroms." As previously mentioned, Gard teaches "the polycrystalline diamond layer can be from 0.5  $\mu\text{m}$  to 250  $\mu\text{m}$  in thickness." 0.5  $\mu\text{m}$  is equivalent to 5000 angstroms, a value that is outside of the range claimed. No where in Gard does it teach a diamond layer having a thickness of between about 50 and 2000 angstroms. In

fact, Gard teaches a preferable thickness is about 3  $\mu\text{m}$  to 15  $\mu\text{m}$ , the minimum thickness of such range being 15 times the largest claimed thickness.

Therefore, it is respectfully submitted that claims 7, 8, and 14 through 18 are allowable, in addition to independent claim 1, because, at the very least, the cited prior art does not teach or suggest all the claim limitations of the claimed invention to establish a *prima facie* case of obviousness regarding the claimed invention under 35 U.S.C. § 103(a).

Applicant respectfully submits claims 33 and 34 are allowable as depending from allowable base claim 27.

Sahara and Gard as a combination fail to teach or suggest all the claim limitations as set forth in independent claim 27, specifically a semiconductor die assembly comprising a substrate having a surface with two passivation layers provided between the surface of the substrate and a layer including diamond. Thus, the cited prior art, either individually or collectively, fails to teach or suggest all the claim limitations as set forth in the claim to establish a *prima facie* case of obviousness regarding the claimed invention under 35 U.S.C. § 103.

Regarding claim 34, the cited prior art fails to teach a diamond layer having a thickness of between about 50 and 2000 angstroms.

For these reasons, Applicant respectfully submits that, under 35 U.S.C. § 103(a), claims 27, 33, and 34 are in condition for allowance because the cited prior art, at the very least, fails to teach or suggest all the claim limitations of the claimed invention to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a).

It is respectfully submitted that claims 55, 56, and 62 through 66 are allowable as depending from allowable base claim 49, in addition to any patentable subject matter contained therein.

Independent claim 49 is allowable over the combination of Sahara and Garg because the cited prior art fails to teach or suggest a semiconductor device having an active surface, having a passivation layer provided over at least a portion of the surface, having a second passivation layer provided over at least a portion of the passivation layer, and a layer comprising substantially diamond provided over at least a portion of the second passivation layer. Because Garg fails to cure the deficiency in Sahara regarding multiple passivation layers between the device surface

and diamond layer, the cited prior art cannot be relied upon to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a).

In addition, the cited prior art fails to teach or suggest a layer comprising substantially diamond having a thickness of between about 50 and 2000 angstroms, as is required by claim 56.

Therefore, it is respectfully submitted that, under 35 U.S.C. § 103(a), claims 49, 55, 56, and 62 through 66 are allowable because the cited prior art does not teach or suggest all the claim limitations of the claimed invention to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a).

Claims 81 and 82 are allowable, among other reasons, as depending from allowable base claim 75.

Sahara and Garg as a combination do not teach or suggest all the claims limitation of the claimed invention. Specifically, the cited prior art fails to teach or suggest two passivation layers located between an active surface of a semiconductor die and a layer including diamond as required by independent claim 75, nor do they teach a layer including diamond having a thickness of between about 50 and 2000 angstroms as required by dependent claim 82.

Thus, under 35 U.S.C. § 103(a), claims 75, 81, and 82 are allowable over Sahara and Garg because at the very least the cited prior art fails to teach or suggest all the claim limitations of the claimed invention to establish a *prima facie* case of obviousness regarding the claimed invention under 35 U.S.C. § 103(a).

Applicant respectfully submits claims 103, 104, and 110 through 114 are allowable as depending from allowable base claim 97, in addition to patentable subject matter contained therein.

Independent claim 97 in relevant part claims a substrate having a surface, a passivation layer provide over at least a portion of the surface of the substrate, a second passivation layer provided over at least a portion of the passivation layer, and a layer including diamond provided over at least a portion of the second passivation layer. The cited prior art fails to teach or suggest the claim limitation requiring two passivation layers between substrate surface and diamond layer.



Therefore, claims 97, 103, 104, and 110 through 114 are allowable, under 35 U.S.C. § 103(a), over Sahara and Garg because the cited prior art, at the very least, does not teach or suggest all the claim limitations of the claimed invention to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a).

Sahara and Rinne

Claims 6, 32, 54, 80 and 102 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sahara et al. (U.S. Patent 4,764,804) in view of Rinne et al. (U.S. Patent 6,389,691).

Claim 6 is allowable, among other reasons, as depending from allowable base claim 1.

Claim 32 is allowable, among other reasons, as depending from allowable base claim 27.

Claim 50 is allowable, among other reasons, as depending from allowable base claim 49.

Claim 80 is allowable, among other reasons, as depending from allowable base claim 75.

Claim 102 is allowable, among other reasons, as depending from allowable base claim 97.

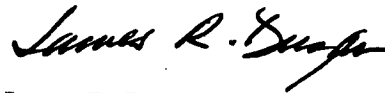
Rinne teaches or suggests a microelectronic substrate 15 having a passivation layer 12, including polyimide (col. 6, line 6), provided on a surface of the substrate 15, an exposed contact pad 14 on a portion of the passivation layer 12, an under bump metallurgy layer 16A-B provided over the passivation layer 12, and a solder layer 22A-B provided over the under bump metallurgy layer 16A-B (col. 5, lines 18-26). While Rinne discloses a passivation layer 12 including polyimide (col. 6, line 6), it fails to remedy any of the aforementioned deficiencies of Sahara, namely the lack of multiple passivation layers located between a semiconductor device surface and a diamond layer, to establish a *prima facie* case of obviousness regarding the claimed invention under 35 U.S.C. § 103(a) because any combination of the cited prior art fails to teach or suggest all the claim limitations of the presently claimed invention.

Therefore, independent claims 1, 27, 49, 75, and 97 are each allowable, under 35 U.S.C. § 103(a) because, at the very least, the cited prior art fails to teach or suggest all the claim limitations of the claimed invention to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a).

**CONCLUSION**

It is respectfully submitted that each of claims 1 through 8, 14 through 34, 40 through 43, 49 through 56, 62 through 82, 88 through 91, 97 through 104, and 110 through 116 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



James R. Duzan  
Registration No. 28,393  
Attorney for Applicants  
TRASKBRITT  
P.O. Box 2550  
Salt Lake City, Utah 84110-2550  
Telephone: 801-532-1922

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JRD/sls:jml

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